Planetary Boundary Layer and Saharan Air Layer top height determination using Ceilometer and Micro Pulse Lidar. Intercomparison for two case studies.

Y. Hernández[1], S. Alonso-Pérez[1,2], E. Cuevas[1], C. Camino[1], J. de Bustos[1], A.J. Gomez-Pelaez[1], R. Ramos[1], C. Córdoba-Jabonero[3] and M. Gil[3]

[1]Izaña Atmospheric Research Centre, Joint Research Unit to CSIC 'Studies on Atmospheric Pollution', La Marina 20, planta 6, 38071, Santa Cruz de Tenerife, Canary Islands, Spain
[2]Institute of Environmental Assessment and Water Research, (CSIC), Luis Solé i Sabarís, 08028, Barcelona Spain
[3]National Institute for Aerospace Technology (INTA), Atmospheric Research and Instrumentation Branch, Torrejón de Ardoz, 28850, Madrid, Spain
Keywords: Boundary Layer, Ceilometer, Lidar, Saharan Air Layer, Saharan dust
Presenting author email: chernandezp@aemet.es

Top heights of the Planetary Boundary Layer (PBL) and the Saharan Air Layer (SAL) during two Saharan dust events were compared by using both a Vaisala ceilometer CL51 (CL51; 910 nm) and a Micro Pulse Lidar (MPL; 523 nm) in Tenerife, Canary Islands.

Ceilometers were originally conceived for both cloud and PBL height detection, but not specifically to measure the dust layer. However, a previous study showed that the CL51 is capable of detecting mineral dust within the SAL (*Hernández et al., 2011*). That study was carried out in the Canary Islands in winter when Saharan dust intrusions occur within the Marine Boundary Layer, MBL, (*Viana et al., 2002; Alonso-Pérez, 2008*), with both the CL51 and the MPL located at the Santa Cruz Observatory (SCO; 28.5º N, 16.2º W, 52 m a.s.l.) a background urban station located in the metropolitan area of Santa Cruz de Tenerife that belongs to Izaña Atmospheric Research Centre.

Two case studies are presented in this work.

From 14 October to 24 November 2011, the CL51 was installed at Izaña Observatory (IZO; 28.3º N, 16.5º W, 2373 m a.s.l.), which is representative of the free troposphere, and the MPL was located at SCO, within the MBL. In this period, an exceptional episode of Saharan dust intrusion at high altitude occurring from 15 to 17 October, 2011 was studied.

During the second period of the inter-comparison, both instruments have been located at SCO within the MBL. Our second case study is the Saharan dust episode occurred in December 5-11, 2011.

The PBL and SAL heights were determined using the gradient method. The PBL and SAL correspond respectively, to the first and subsequent measurable minima of the derivative of the CL51 and MPL backscatter signals. Also, we have developed a methodology for determining the SAL heights using relative humidity (RH) and temperature vertical profiles from radiosoundings.

Our results have been analysed using ancillary information: 1) analysis of airmass origin reaching the site, perfomed using both HYSPLIT 4 and ECMWF backtrajectories; 2) simulations of vertical profiles of dust concentrations using the BSC-DREAM8b dust model; 3) vertical profiles of temperature, RH and wind direction from radiosonde and ozonosonde stations, at Güímar and Jardín Botánico respectively, both in Tenerife 4) aerosol optical depth from Izaña and Santa Cruz de Tenerife AERONET stations; 5) Moderate Resolution Imaging Spectroradiometer (MODIS) and Meteosat Second Generation (MSG) satellite imaginery 6) ECMWF and the non-hydrostatic mesoscale meteorological MM5 models and 7) heights of PBL and aerosol layers and extinction coefficient measured at SCO provided by the Micro Pulse Lidar Network (MPLNET).

We have found a good agreement between the Vaisala CL51 ceilometer and the MPL in the determination of the PBL and SAL heights, noting that in winter season is more challenging for the MPL to detect dust layers because they travel at lower altitudes. The SAL heights determined by RH and temperature vertical profiles are also in good agreement with the results obtained by CL51 and MPL.

We would like to thank to Vaisala for providing the ceilometer CL51. Thanks to Reijo Roininen for the information about the ceilometer. Yballa Hernández enjoys a grant from the Meteorological State Agency of Spain, Ministry of Agriculture, Food and Environment of Spain to carry out studies in remote instrumental techniques.

Alonso-Pérez S. (2008) *Caracterización de las intrusiones de polvo en Canarias*, PhD Thesis, Universidad de la La Laguna, Centro de Publicaciones de la Secretaría general Técnica del Ministerio de Medio Ambiente, Madrid, ISBN: 978-84-8320-473-3.

Hernández, Y., Alonso-Pérez, S., Cuevas, E., Camino, C., Ramos, R., de Bustos, J., Marrero, C., Córdoba-Jabonero, C., and Gil, M. (2011) *Micro Pulse Lidar and Ceilometer inter-comparison during Saharan dust intrusions over the Canary Islands*, Proceedings of the V Reunión Española de Ciencia y Tecnología de Aerosoloes (RECTA 2011), Madrid (Spain), ISBN: 978-84-7834-662-2.

Viana, M., Querol, X., Alasstuey, A., Cuevas, E., and Rodruíguez, S. (2002), *Atmospheric Environment*, 36, 5861-5875.